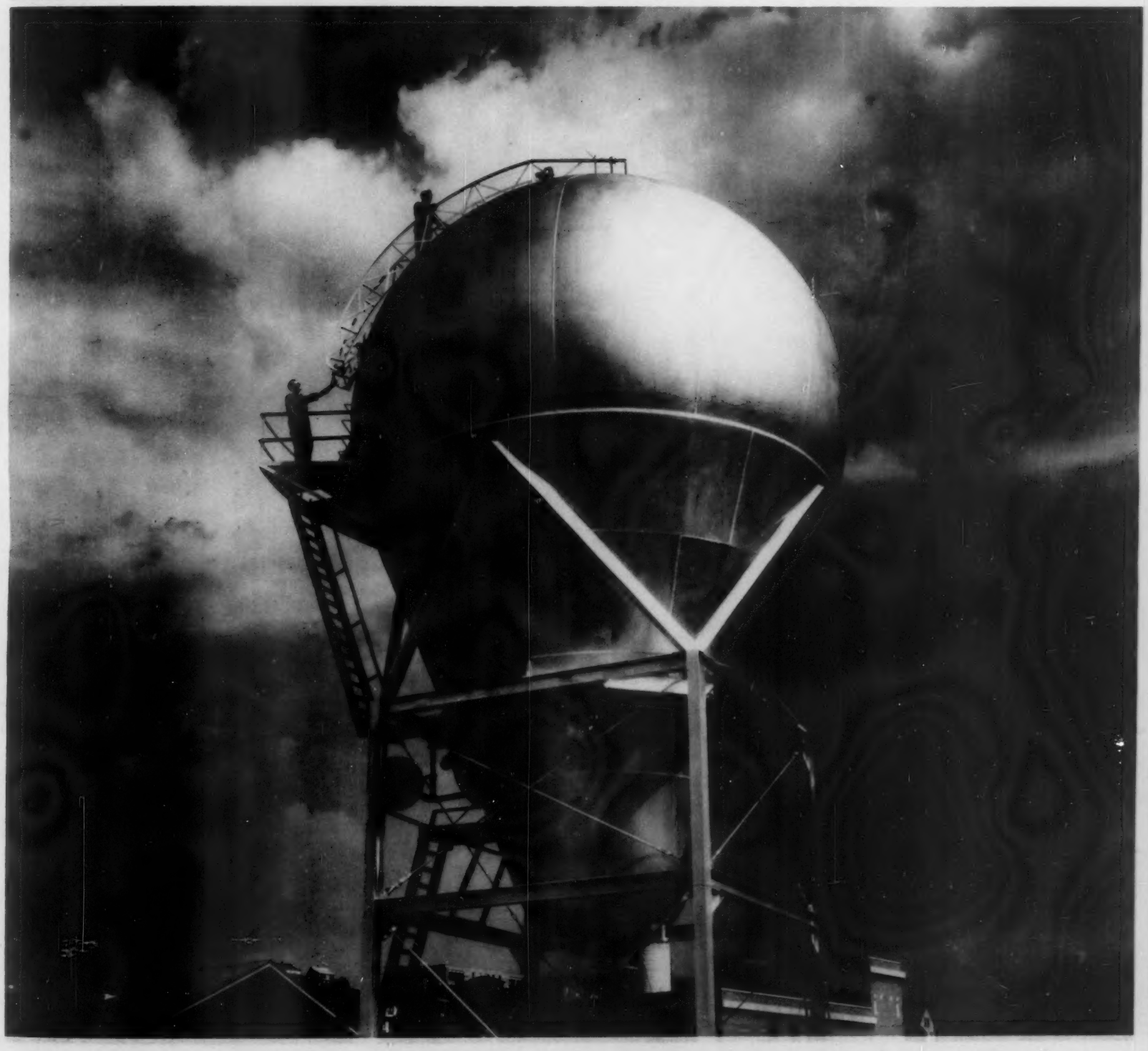
TECH ENGINEERING NEWS



MAY · 1939

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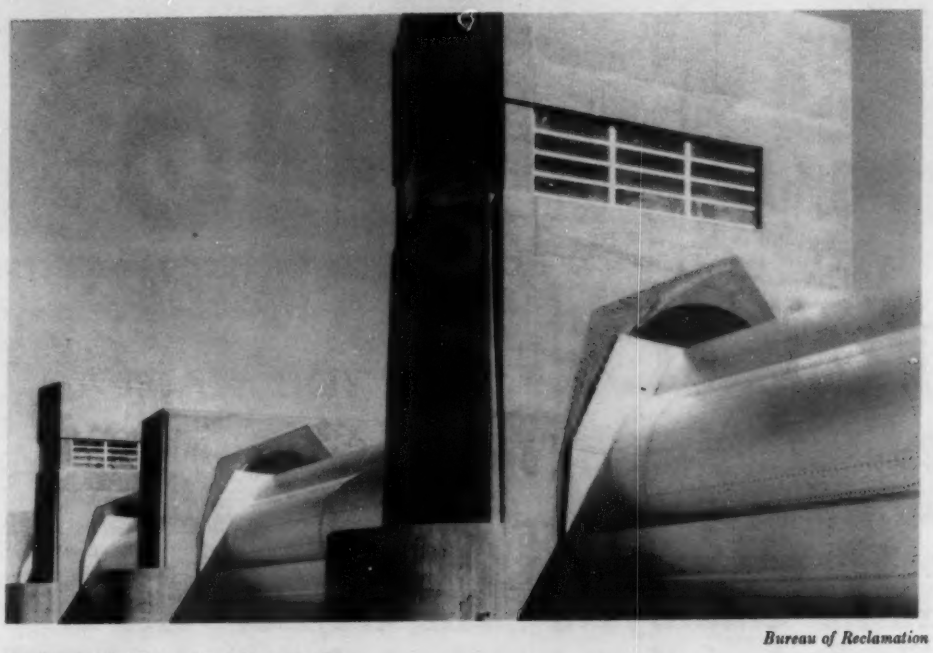
C O N T E N T S

Vol. XX No. 4



Bureau of Reclamation

OUR COVER THIS MONTH

This pear-shaped structure is the completed atom smasher built by Westinghouse in East Pittsburgh. On the left rests one of the giant rotary dams of the all American Canal.

MAY 1939

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AND NEXT TERM

The staff of THE TECH ENGINEERING NEWS will continue to expand its efforts closer to the interests and accomplishments of the Institute students, professors and alumni. At the same time it will contain authoritative articles by men of science, engineering, and industry off the campus.

THE TECH ENGINEERING NEWS

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1 WRITING THE LETTER

By E. Hustredt, '41

2 ACTIONS AND REACTIONS DURING INTERVIEW

WPA

THE JOB THAT YOU WANT

The following four articles were written and coordinated to show prospective employees what business employers will expect and demand of them. We believe that the information presented here will help you who are looking for jobs, whether it be for life or just for the summer.

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1 PROF. F. G. FASSETT, JR., Editor of "Technology Review," emphasizes the salient points to be considered when contacting a potential employer by letter.

WRITING a letter of application nearly always demonstrates to the author the truth of the old paradox that the seemingly easiest things are the most difficult things to do well. The difficulty on which this demonstration hinges grows out of the fact that in writing this letter you are forced to try to ride two horses at once — to talk about yourself and yet to seem not to do so. The job of being objective about the subjective is inevitably embarrassing to every writer and leads him into a great many dunderheaded efforts to be either the naive, ingenuous, and dewy-eyed young hopeful or the aggressive, bombastic executive with nothing to execute. This discussion cannot hope, and does not undertake, to render you immune to such dangers. It can, however, point out a few methods of insurance.

Little need be said about the content which a letter of application should present. Examination of a few of the exhaustive questionnaires sent out each spring by large employing concerns will evidence that almost any kind of information is going to be demanded by one or another of prospective employers. With a disarming incoherence that seems to have something Machiavellian about it, some of these questionnaires go at a merry hop, skip, and jump from the marital status of the applicant to the health of his father and what he likes to do in his spare time, with all sorts of incidental questions scattered among these highlights.

This deliberate descent into the bewilderment of the *non sequitur* — though it may lead some applicants to scurrilous remarks about the compilers of questionnaires — is a very shrewd thing. The applicant who has enough analytical capacity to get into sensible categories the great mass of unrelated detail which the unrelated questions have brought into the forefront of his mind and who has enough respect for his own judgment to follow those categories rather than the questions themselves in writing his letter is probably the kind of man that one would like to hire. That is what the personnel man wanted to find out. In general the old plan of a five-section letter which applies for the job, states education, states experience, states references, and asks an interview is still dependable. It is not here that you find insurance against the central difficulty earlier mentioned.

This insurance may be discerned if you consider the purpose for which a letter of application is written. And it should be said in passing that the letter of application, like a great many other things, is a beautiful illustration of the classic tendency of men to let practical expedience crystallize first into convenience and then into ritual, as will appear. You write your letter; in it you apply for a job; ostensibly you write the letter because you want a job. Actually, you know — and the personnel man knows — that you are writing a

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FOUR WAYS OF WORKING

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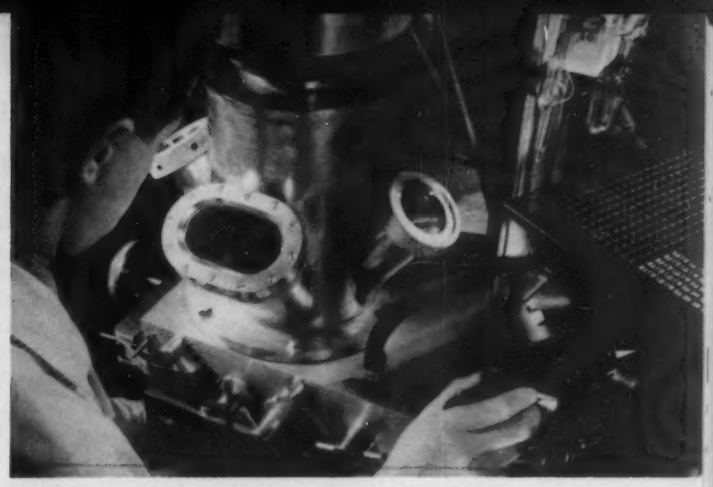

4

MAKING A SUCCESS OF YOUR JOB

letter not to get a job but to get an interview. Your prime motive, then, is obscured by what is, after all, a pretty stupid maintenance of a pretty stupid custom. But it is convention that you should apply for a job in order to get an interview.

Now consider for a moment the poor personnel man. Yonder he sits, his desk swamped by the annual spring crop of letters from earnest young hopefuls. Ninety per cent of them follow the five-category plan, utilizing the same stock language in about the same sequence. The personnel man has in prospect interviews with a number of gentlemen represented in the mass of piled up screeds before him. If he gauges these unseen interviewees by their letters, it is a reasonably safe bet that ninety per cent of them appear to his dreaming mind almost as alike as two olives in a bottle. Reckon, then, with the entirely natural inertia which must, despite his best efforts to prevent it, descend upon him now and again.

The letter from that mass which possesses individuality within the five-category form, which shows dexterity and subtleness in meeting the central difficulty, and thus gives evidence that its writer is shrewd enough to recognize that he is playing an old game and had best play it with finesse — that letter will suggest to the personnel man that here is a prospective interviewee whose conversation may be interesting above the dead average level. How, then, to give evidence of this dexterity?

Specifically, the answers are to be found in any of the myriad discussions of English prose style. The ingenuity which can make one first-personal pronoun govern three or four verbs so that the I's do not have it all the time is likely to appeal to the reader as the kind of ingenuity which will be quick to learn the sort of manipulation necessary in the industry to which the application is addressed. Conversely, the kind of mind which says, "The writer was born in Southeast Bench Mark in 1903, and the years since then have been spent in such and such ways," is likely to be regarded as produced only by the sort of young gentleman who removes his hat whenever he looks into a mirror.

Dexterity which indicates that you are able to use your mind as an instrument, control it with the surety with which you drive an automobile, is, then, the first insurance against the central difficulty. The second, greater in itself, is to remember that you will be interviewed more because you show some comprehension of your reader's needs and desires than because you tell your reader how able a man you are. To be objective about the subjective — that is, to write about yourself as though you were Bill Smith in the far corner of the room — is easier when you have some purpose beyond the mere detailing of Bill's good qualities. Essentially, you are trying to sell Bill. It is much easier to do so if you indicate that you understand the market.

2 FINDING A JOB FOR A MAN

Extensive study in the Humanities has made Assoc. Prof. F. ALEXANDER MAGOUN especially conscious of the most effective manner for students to make favorable impressions on interviewers.

A SUCCESSFUL interview is the last step in finding a job for a man. Sometimes, though not always, it is preceded by a job letter, the object of which is to obtain the interview. Most important of all — by any standard that makes sense — it must be preceded by an accurate, penetrating analysis of what the job hunter needs and where he belongs in the scheme of things.

Nobody is interested in someone looking for "a" job; you must be in search of "the" job. To do this requires:

(1) a knowledge of your abilities
(2) a sense of the customer's needs
(3) an ability to show how your product fits the customer's needs

All three of these considerations must be given adequate attention long before the applicant walks in for his interview. The first item is by far the most difficult to answer correctly. Very few people ever do get the right answer (hence, the multitude of square pegs in round holes) and still fewer know what constitutes a good method in finding an answer.

However, I was asked to discuss the interview itself, so we must assume — knowing full well the assumption is unwarranted — that the applicant has spent many hours of scientifically directed inquiry finding out what he has to offer and discovering the sort of company which can use it. Your qualifications must fit the qualities required by the job.

But to stop there is to ignore an equally important question, often overlooked. The benefits offered by the job must also suit your tastes (what you want to do) and your standards (what you do *not* want to do). An interview is a buyer-seller relationship both ways. The employer is buying services and selling the environment in which the services are given; the applicant is selling his services and buying the men he is to work with, the community where he is to live, and perhaps even the social organization where he is to meet the girl he will marry or the school where his children are to be educated.

The two common causes of failure are ignorance of self, and ignorance of what the job requires.

So you arrive promptly for your interview, well scrubbed, wearing the sort of thing you would be expected to wear (which of course varies with the job),

and fortified with a thorough knowledge of what you have to offer, a reasonable expectancy that the company has use for it, a pretty good idea of what evidence the employer is going to want from you, a carefully worked out plan of how to make the evidence evident, and a recognition of your being a buyer as well as a seller. You already know exactly what you are applying for and can also see the situation from the interviewer's point of view. The proper answer to "I'll take any opening you have for me," is, "Take that one over there and please close it on your way out."

A good interviewer will collect important evidence from your dress, hair, eyes, poise, handshake, and manner of self-expression. Often he will form an opinion before you sit down and spend the next twenty minutes merely checking that opinion. You will be judged by *everything* you do, including what you did in the waiting room.

The best advice anyone can give you is to be as natural as possible. Indeed, if the interviewer does not put you completely at ease so that you can be your real self, he does not know his job. If he asks you a chain of questions like, "Where were you born?" "When?" "What high school did you attend?" "What course did you take at M. I. T.?", 'Why?" you can know at once that he does not know how to ask questions. He is using a crowbar to pry the answers out of you. A good interviewer will begin with something like, "Tell me about yourself," and he will learn a lot just by observing where you begin, how well organized your material is, and whether you merely state facts as facts, letting him draw the conclusions, or try to interpret your facts. There is a vast difference between the man who says, "I was editor of *The Tech* and president of my fraternity" and one who adds, ". . . therefore I'm a darn good man!"

Get over the idea that an interviewer is trying to keep you from getting a job that you want. He is sincerely trying to evaluate where you can do the best work and be the happiest. Perhaps you want to get something under false pretenses. Let us assume that you bluff successfully. You are then using your own evaluation and denying yourself the opportunity of an impartial evaluation by an expert.

Be yourself as naturally and as completely as possible. If a company sends two men to interview one senior it is not being fair, because this makes it almost impossible for the senior to relax and be himself. In the end the company loses because it has made it more difficult to get at the truth and good men will not stand for such methods.

Students often ask me, "What is the right answer to this question, . . . " My reply always is, "The only right answer to *any* question is your honest answer. Getting a job is much like finding the right wife. If it is going to be a happy marriage it must be an honest marriage, not a seduction."

A good interviewer will ask you two types of question; matters of fact and matters of opinion. Always answer a matter of fact at once, else you seem to be hiding something. The result is that whenever anyone suspects you of having a card up your sleeve, he always reacts as though it were the ace of spades and often it is only the two of clubs.

With matters of opinion it were better to hesitate. Be sure you have all the facts. Any interviewer who knows the simplest elements of his job will ask you one question while really looking for the answer to another. Elliott Dunlap Smith, who achieved an international reputation as personnel manager of Dennison's, used to say to students who applied, "Some of our foremen tell me that college men fail because they pay too much attention to detail. Other foremen say they fail because they don't pay enough attention to detail. What do you think?" Smith knew perfectly well no senior could give an intelligent answer to that question. What he wanted to find out was how the senior's mind worked. The analytical student will ask, "Which foremen? Are they talking about the same kind of details?" Whereas the bluffer or the conclusion-jumper will at once sound off with an opinion.

That is a stunt that works both ways. One of the Course VI seniors used it this spring when asked if he had questions about the company that was interviewing. "Yes, I'd like to know what per cent of the college

FOR MEN TO WORK, NOT BOYS TO PLAY

men in your company who were hired five years ago are now married."

"Why, all of them, of course."

"What do you base your figures on?"

"Well, I really don't know the answer. Why did you ask?"

"Because it gives an indication of the kind of stability they feel and perhaps something about the kind of community they live in."

But the senior also learned that the personnel man would bluff. If you were the president of a first class company would you want to be represented to the public by a bluffer? In the long run would you want to work for a company which was willing to be represented by one?

You will do well to remember that companies do not hire just brains, or hands, or feet — they hire men, and the interviewer will try to see the man as a whole. If learning were all that is necessary, the Placement Office would receive a requisition for so many engineers with a specified cumulative rating. Industry hires men, not marks, and will be interested in:

(1) Your habits of study
(2) What you have studied
(3) Your ability to use it
(4) Your physique
(5) Your ability to co-operate with others
(6) Your ability to make others want to co-operate with you.

Put yourself in the interviewer's place. Try to help him to see what your fundamental aptitudes and

interests are. What independent creative work have you ever done and what is the evidence of it? Can you produce a copy of the TECH ENGINEERING NEWS with an article by you in it? Is a copy of your thesis worth looking at? Can you produce a sales record for a summer job? What kind of personality and character do you have? What activities are evidence?

"How about your experience," says the industrial scout. He has called the signal and thrown the ball to you. Now you take control of the interview because you are the authority on your experience and should go as far down the field as possible till that particular play is over. Then the ball goes back to him to call the next play. The kind of path you take down the

Westinghouse

field will show what kind of a player you are and what you know about the location of the goal posts. Tell all. Tell it accurately and succinctly.

"You'll have to start at the bottom," said the railroad executive to the Course I man. "Now how about your experience?"

"Summer before last I trucked freight for three months. We handled miscellaneous merchandise in less than carload lots. Last summer I was a clerk in the classification yards at East Flagstaff, checking waybills, cars, crew releases, and making up cut slips."

"Cut slips?"

"Yes — for the hump-tickets in duplicate from the waybills; one for the conductor of the hump engine and the other for the tower-man. What I'd like now is waybilling. I can use a typewriter."

Just because you have had no experience, do not feel that you have nothing to offer. In young college men, employers are looking for background, energy, enthusiasm, and ability to work. Does your college experience show evidence of these things? Do not try to sell yourself, sell your results.

If you need to be told to be on time; not to interrupt; not to muss up the interviewer's desk or read papers on it; to sit straight but not stiffly; not to throw your hat and coat around, derange things, or wear your socks at half mast, you do not deserve a job. But you will perhaps need to be told that the proper days for an interview are usually Tuesday, Wednesday, and Thursday; that the afternoon is better than the morning; and that for a beginner, the question of salary is best left up to the company. But know what the going rate for Technology seniors is.

For goodness sake, when the interview is over, get up and go. Make your exit as prompt, as dignified, and as effective as your entrance. And if you are a college man remember that it is not just you, it is the whole college you represent.

Lastly, do not go back after you have been rejected and say, "What was wrong with my first interview?" That implies that by some trick you might have secured the job. Go back — if you feel sincere about it — and say, "Why didn't you want me when I feel so very strongly that you are the one company that I want to work for, and that I can serve your needs in the . . . (specific place) department?" It is the preparation that led up to the interview that really counts most.

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3 FAT MAN, SMART MAN, GROUCH OR MISTAKE, which will you be a few years after graduation? Written by NATHANIEL McL. SAGE, head of the Institute Placement Bureau.

CURIOSITY about the future and speculation as to what will or will not happen are rife among the about-to-be-graduated, particularly at this time of the year. The realization that they face new experiences and problems fills them with a mixture of enthusiasm and apprehension. Some favored individuals have had, prior to graduation, industrial experience along the lines that they intend to follow after graduation. The immediate future for them contains relatively few unknowns. This article is designed more for the man without this very beneficial background.

A complete story of what happens to Tech men after they graduate would amount to a biography of each individual. This is obviously impossible. Another method of attack might be to tell what happens to John Doe when he enters engineering research or some other branch of endeavor with a certain type of company. This becomes too involved because of the diverse and complex organization of different companies in the same industry, and when you complicate this with the diversity of industries, it becomes too broad a subject. This forces a broad generalization of Massachusetts Institute of Technology graduates into approximately four classes.

In the first class are men who drop into openings and pretty much follow heroes in fairy stories, in that they get married and exist happily ever after in the company to which they first went. Percentagewise they represent a minority. The larger and more foresighted companies today recruit annually such men as they feel their company can absorb. It is from this group that they expect to create their future executives. Promotion within the company is, as nearly as possible, a fixed policy. Because of this quite modern condition, it is safe to assume that as the years pass the number of men in this category will represent a very much larger part of the whole.

Another class might be those men who are employed on graduation and who outgrow their environment. In other words, they become more valuable to another employer than they are to the man who originally hired and trained them. As a consequence they are booted upstairs into positions of larger responsibility and larger salary. In general they have established a record of accomplishment and have their feet on the proper path.

The third group consists of less fortunate individuals who, after a year or two, find out that they are in the wrong company. Several colleges have made rather elaborate studies of their graduates who fall into this category. Seventy per cent of these cases occur because of poor handling of personal situations, rather than lack of technical training. Perhaps the most common source of trouble is the desire among recent graduates to have everybody know how good they are, and the mistaken belief that this can be accomplished by use of the vocal chords. Too much ego plus too much talking plus a little unreasonable impatience will earn a man an unattractive label that may take years to live down.

Fortunately nearly everyone learns by making mistakes and the men who do learn can, if they preserve their sense of humour and sense of values, go through the trials of relocating and making a new start without permanent damage to their future. However, they have wasted valuable time in discovering an important fact of life which should have been hammered into them in their early youth.

A fourth class might be made up of men who have acquired an engineering education, and who because of personal qualifications and individual likes and dislikes find out that they just are not cut out to be engineers. They consequently give up engineering for business, and some of them are sufficiently successful to make the engineers scratch their heads and wonder why they were not wise enough to follow suit.

Considering the careers of a large number of graduates, there seem to be certain common factors that contribute enormously to success in any walk of life. The ability to work hard before it is necessary, plus a sense of timing transactions so that the old saying about striking while the iron is hot applies, plus a willingness to try to find the answer for yourself, and plus a cheerful disposition and the ability to get along with other people, are enormously desirable attributes. When the type of courage that prevents one from being a buck-passer and a "yes" man is added to this equation, you get your potential executive. Anyone who has developed these attributes by the time he is thirty is probably well on his way to success. Given normal breaks, at the age of forty he is the type that allows faculties to point to him with pride and use him as a living example of the benefits of their brand of training.

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4 SUCCEEDING ON A JOB

MR. C. F. ROCK, of the Personnel Department, General Electric Company River Works, tries to help you get started right and keep you in the groove that will mean your succeeding on that new job.

THE suggestion has been made that one way to get and hold a job is to marry the boss's daughter. No doubt that procedure has been followed with some success, but as all bosses do not have daughters, and as many a swain discovers his mate among the daughters of those who merely work and do not boss, certainly there must be other ways of effectively meeting this situation.

It seems to me that succeeding on a job depends upon two main factors: the things you have done to prepare yourself to succeed before actually getting a job, and the things you do after an employer has put you on his payroll. Let us first consider some of the items which may be included in the preparatory period.

Your parents have had a very important part in influencing your present attitudes. Have your parents helped you develop a sense of values? Do you understand the importance and significance of real work? Have you earned money through using your own hands and brains or have you relied entirely upon others to provide you with the means for living and pleasure? If you do not have an understanding and an appreciation of such fundamental matters, it is likely that your parents have been too busy with their own affairs to bother with such things, and you should set about helping yourself. The time is not far off when you will have to strike out in the world, making your own way, and you will find that these primary qualities will stand you in good stead.

The fact that you are privileged to attend an institution of higher learning may give you a feeling of self-importance — which is not well founded. While it is readily agreed that a trained intelligence is highly important, there are other factors besides a college education which make for success. It should be realized that only about half of the young people with the best brains in this country go to college; the rest have to get jobs, and contribute to the family support. Therefore, let not the fact that you are a college man lead you into believing the fallacy that all of the best minds are in, or have come from, college halls.

Again, you should realize that much of your undergraduate time has been spent in an environment which is somewhat removed from the world of reality. Colleges exist for the students. The faculty, plant and equipment, and the curriculum are selected and designed to promote the best interests of the students. Course follows course and year follows year. While it is expected that students should meet certain requirements along the way, the acquirement of college credits is still largely measured through exposure in terms of years rather than through excellence of performance. Also, colleges are not "going concerns"— it is necessary to call constantly upon alumni and other friends for financial assistance in meeting deficits in operating expenses.

Business and industry, on the other hand, although organized to render a service to society, must, under our capitalistic system, make a profit if the service is to continue. Under these conditions, activities no longer center around the individual — when he is hired it is expected that he will contribute to the best interests of the business. His pay is in accordance with his performance, and as soon as one job has been learned he does not necessarily move to the next one higher up. In other words, the success of the business comes first, and the individual fits in as best he can in keeping with his abilities and the opportunities available.

If we consider for a moment the normal activities of life, we find that part of our functions are concerned with understanding and getting along with people and that there are other functions which deal with material things. It is with the latter, in the minds of many, that engineers are primarily associated. For years the courses of engineering schools have been so arranged that practically all of a student's time has been devoted to a study of things. Perhaps there are available a few elective courses in the arts and the humanities, but few students, either voluntarily or through the encouragement of faculty advisers, take advantage of such opportunities to broaden their understanding. In other words, the engineering graduate is well prepared to deal with things, but too often he does not understand

(*Please turn to page 85*)

Transparent Cellulose Films

From viscose solutions to regenerated cellulose film — newly formed film not yet entirely transparent coming out of the coagulating bath

All pictures courtesy E. I. duPont Co.

LIKE AN OCTOPUS, THE CELLULOSE FILMS INDUSTRY HAS ENVELOPED THE FOOD AND DRUG BUSINESSES AND ITS LONG TENTACLE-LIKE RIBBONS ARE NOW REACHING INTO THE ELECTRICAL AND OTHER FIELDS.

A. CARLETON JEALOUS, '42

SLOWLY, yet steadily, people and articles of commerce appear in increasing numbers wrapped in transparent films, literally as well as figuratively. In many different colors, sheets of the material are made into gay raincoats, umbrellas, and shower curtains, to mention only a few things, and are used as wrappers to heighten the appearance of quality of practically any salable product.

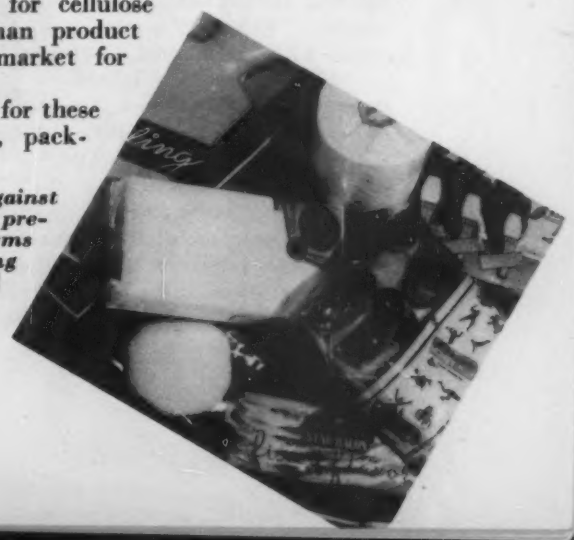
There are at least three different cellulose-derivative films on the market. The E. I. duPont de Nemours Co., the largest producer, manufactures a regenerated cellulose film trade-marked "Cellophane"; the Eastman Kodak Company manufactures a cellulose acetate material which is made into a film trade-marked "Kodapak"; the Monsanto Chemical Company uses cellulose acetate to make rigid sheets, rods, and tubing, the sheets selling under the trade-name of "Vue-Pak"; and the Dow Chemical Company produces an ethyl cellulose film trade-named "Ethofoil."

The commercial production of transparent regenerated cellulose film dates back to 1908, when Dr. J. E. Brandenberger, a Swiss chemist in the employ of a French textile house, made a lustrous cotton fabric by applying viscose and then imprinting it. The fabric was too stiff for use, however, and this fact led Brandenberger to attempt to produce a thin lustrous cellulose film to be applied to the cloth after formation. He built the first machine for the continuous manufacture of the film in 1908. Though the first sheets were thick and brittle, by 1912 he had a thin, supple film comparable to the marketed "Cellophane" of today. But it was too expensive for widespread use and was treated as a luxury, being used to wrap only perfumes and expensive boxes of candy.

Late in 1923 Brandenberger, with several associates, came to the United States to confer with duPont, bringing with him an improved product. The sum and substance of the conference was duPont's acquisition of the manufacturing rights in North America and the immediate formation of a duPont subsidiary to manufacture the film in a new plant at Buffalo. From $2.65 per pound at Buffalo in 1924, "Cellophane" has come down to around $0.34 per pound and is now manufactured at two plants in Buffalo, two in Richmond, Va., two in Old Hickory, Tenn., and one in Clinton, Iowa.

The history of the manufacture of cellulose acetate and ethyl cellulose films, both of which are more recent commercial developments, has not as yet transpired. It is known, however, that ethyl cellulose was first introduced industrially by Doctors Leuchs and Lilienfield in 1912. As for cellulose acetate, the Eastman product has been on the market for five years.

The largest use for these films is, of course, pack-



Your protection against disease: Cellophane prevents dirt and germs from contaminating store goods exposed by display

aging; but there are many more uses and possibilities for the transparent wrapping materials such as ultrafiltration in bacteriology and chemistry, and insulation in electrical apparatus. Treating each film separately, let us see how and why these commercial products are of value to other businesses and science.

Cellulose acetate film is very pliable, possesses thermoplastic properties, has exceptional resistance toward actinic light rays, or sunlight, and is very slow-burning. The film is also waterproof since cellulose acetate is insoluble in water. It is not moisture proof except when specially treated, so that it will transmit water-vapor. Thus regular cellulose acetate film will not soften when used to wrap foods such as celery which must be kept wet. Because of its pliability and water-insolubility, it is a good dielectric material, many uses having been found for it in electrical equipment. Cellulose acetate sheets which are thicker than the film and therefore more rigid, make excellent containers for almost any kind of merchandise that is put on display.

The most recent addition to the family of cellulose derivative transparent sheetings is "Ethofoil," Dow ethyl cellulose, cast into a brilliantly clear film. As ordinarily furnished, it contains no plasticizers since ethyl cellulose is inherently a highly flexible film-forming material. "Ethofoil" is a thermoplastic sheet whose physical, chemical, and dielectric properties combine to make it an interesting material for electrical insulation, display boxes, window packages, and for a transparent printing base.

It is the lightest available cellulose derivative film, but is strong and unusually flexible. For example, one pound of "Ethofoil" yields 24,000 square inches of film one mil thick having a tensile strength of 9,600 pounds per square inch, and an extensibility of 30 per cent. It transmits all light rays present in sunlight and will pass ultra-violet rays down to 2,250 Angstroms wave length. It retains its toughness and flexibility on exposure to light, and to temperatures up to its softening point of 270° F. Wide variations in atmospheric temperatures and humidities change the dimensions of "Ethofoil" very little because its normal moisture content is low, being only 1.5 per cent at 70° F. and 90 per cent relative humidity.

"Ethofoil" has a slow burning rate and is odorless, tasteless, and nontoxic. It can be sealed to itself or laminated with paper, cloth, and the like by solvent adhesives. "Ethofoil" is easily printed and embossed.

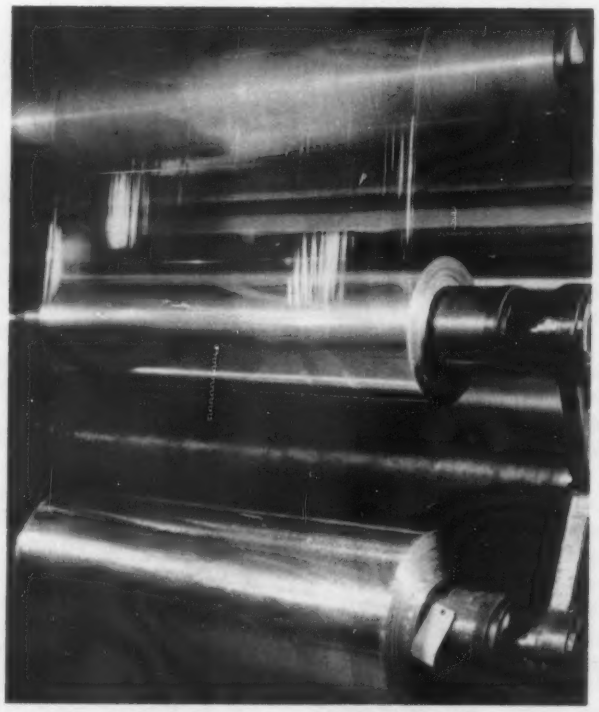
"Ethofoil" is an interesting insulating film having a low power loss even under high humidities. It causes no corrosion on contact with bare copper conductors at high humidities as do paper or cotton insulations. Its dielectric strength is high and relatively unaffected by wide variations in atmospheric conditions. It is used as a wrapped insulation on wires, coils, and bars, and remains taut under extreme changes of weather. "Ethofoil" is insoluble in petroleum naphthas so that insulating varnishes containing such naphthas for thinning may be used on the wrapped insulation without dissolving the latter.

Finally we come to the regenerated cellulose film. This material has excellent elasticity and tensile strength, but the latter is greater in the longitudinal direction or direction of movement in the process of manufacture. Its greatest elongation is in the transverse direction. Thus in packaging, the direction in which the greatest strength is needed, is covered by the longitudinal direction of the film.

Another property of the film led Dr. A. H. Pfund to experiment successfully with the film in heliotherapeutic treatments. He found that the film would transmit a high percentage of the light in the so-called curative range. Tests showed that of all the commonly used cellulose films, the most permeable to ultra-violet is regenerated cellulose. Thus for a few cents and a little ingenious craftsmanship anybody can have a window which will transmit the health-aiding rays of the sun when such treatment is advised by the doctor.

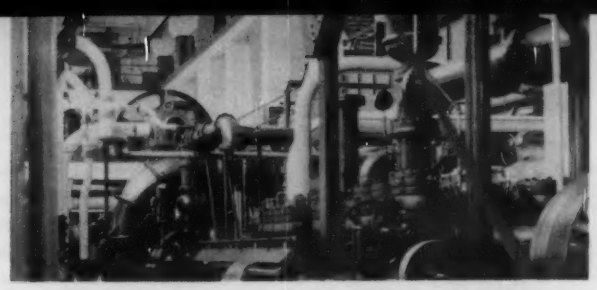
The permeability of the material to gases is extremely interesting. Water vapor and water soluble gases, such as ammonia and carbon dioxide, rapidly penetrate the film; but sparingly soluble gases like hydrogen and helium do so slowly. The film can therefore be used to separate mixtures of gases and also to line the cells of hydrogen and helium ships. In the latter use, the cellulose material is supported from undue strain by a fabric. Its service for this purpose surpasses that of gold beater's skin, for diffusion of the gases is further reduced by the film.

As a membrane for ultrafiltration, it has very usable characteristics. Particles of widely differing dimensions may be separated from one another by it. For example, in dialysis work in which there is neither excessive acidity nor alkalinity, regenerated cellulose film far surpasses fritted glass discs in separating crystalloids from colloids in water or organic solvents. Swollen by water, the membrane will hold back all but the finest colloidal particles. The size of the pores may even be reduced beyond this point until only the finest molecular particles may pass through. The rate of filtration may be satisfactorily increased by the application of pressures up to fifteen atmospheres. In a test of a swollen membrane treated with a dilute solution of collodion to make still finer pores, 90 per cent of the sugar in a 35 per cent solution was removed. The amount of water retained by hydration was determined to be in the ratio of four molecules to one of sucrose. Similar membranes are therefore used in colloidal and biological investigation, and in physical chemistry to study aqueous and non-aqueous solutions.



Completely formed regenerated cellulose film being rolled onto large cores ready for use

(*Please turn to page 86*)



Editorials

ELECTIONS

Each year a new group of men are initiated into the various types of publications work connected with the TECH ENGINEERING NEWS. Not only are the men interested in the publications work for its own sake but the opportunity for recognition in Institute activities is offered them.

Few of these men will continue in this field upon graduation. Past records show, however, that some will retain their interest and in all probability achieve responsible positions upon the country's leading magazines.

The first step upwards for the new men is the May elections of the TECH ENGINEERING NEWS. First year men who have shown ability, interest, and initiative in the magazine are elected assistants in the various departments.

This election also marks the founding of a new department, the Photographic Department. This will enable the TECH ENGINEERING NEWS to better secure pictures pertaining to Institute activity, thus enlarging the reader-interest of the magazine.

Assistant Editors elected are J. Coe, C. Jealous, C. Speas, T. Lindsay, J. Shaw, and W. Wilcox, class of '42. In the Circulation Department, Assistant Managers will be W. R. Johnson and W. P. Johnson, class of '42. John Uhlemann, class of '42, will be Assistant Publicity Manager. In the Business Department, G. Webb, '42, will be Assistant Advertising Manager and Assistant Treasurers will be R. Shainin, W. Vallette, and H. Lemaire, all of the class of '42. Assistant Art Editor will be D. Wells, '42 and Assistant Photographic Editor P. Westerveldt, '42. Members of the General Staff will be G. Bliss, '43, G. Brown, '42, and R. Thomas, '42. C. Bien, '42, Assistant Personnel Manager.

INDUSTRIAL DEVELOPMENTS

Under the supervision of Alfred P. Sloan, Jr., M. I. T. '95, chairman of the General Motors Corporation, duplicate telegrams were sent to the 100 most progressive companies in the United States asking the heads of those companies to reply briefly with a statement of their most significant recent accomplishments of research and product development. This information was used in the keynote address at the dedication of the General Motors exhibit building at the New York World's Fair.

A few of these accomplishments should be of interest to the reader and are digested in the succeeding paragraphs.

The Allis-Chalmers Mfg. Co. has introduced a one-man-operated harvesting machine, which, in a single operation, cuts, threshes, separates, cleans, and bins more than one hundred varieties of grains, beans and seeds, ranging in size from red kidney beans down to bird seeds. All this is accomplished at a labor-cost of one man-hour per acre when harvesting commercial grain.

The Cemenstone Corporation makes available standard precast concrete shapes which simplify fireproof construction and lower its cost through mass production.

Fluid drive, introduced by the Chrysler Motor Corporation, is a method of transmitting power from the engine to the rear axle without the usual continuous mechanical connection. This not only eliminates the clutch and gearshift but it paves the way for automatic transmission and new methods for transmitting power to driving wheels.

Intensive chemical research at the E. I. duPont deNemours Co. has brought forth a wholly new organic material derived basically from coal, water, and air, together with other materials.

The textile filaments made from this product are stronger and more elastic than any fiber now in general use. The threads can be drawn as fine as a spider's web. It is to be used for hosiery, tennis racquet gut, strings for musical instruments, brushes, and related products. An $8,000,000 plant is now being constructed in Delaware for the production of nylon.

A unique process developed by the Ethyl-Dow Chemical Co. in North Carolina treats 200,000 gallons of seawater per minute to remove one pound of bromine per ton of seawater. Bromine has wide use in antiknock fluids, photographic and medicinal industries, and national defence.

General Electric Co. includes among its many new products a high pressure, high temperature steam turbine with hydrogen cooled generators, and also mercury vapor turbines for greater economy and efficiency in electric power generation.

In the last five years the General Motors Corporation has established a modern Diesel locomotive plant near La Grange, Ill., which boasts fourteen acres of buildings and three thousand jobs, all of which did not exist in 1934.

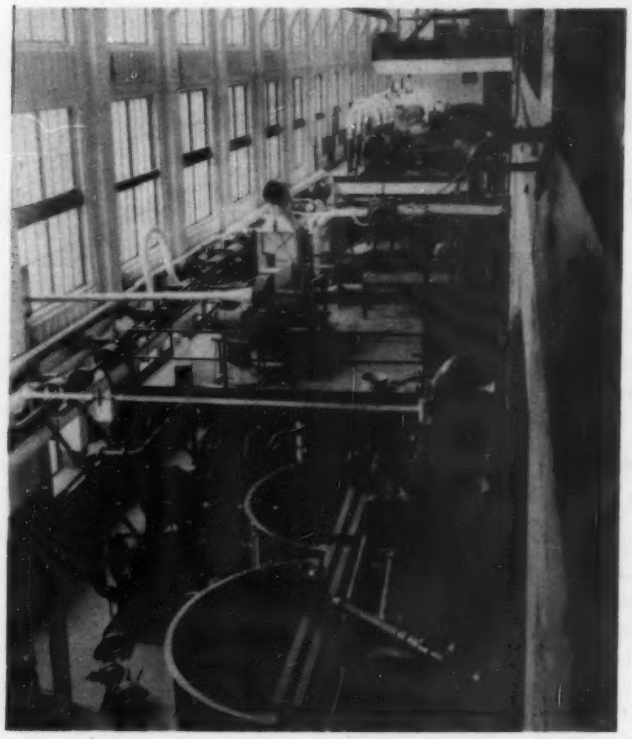
The Goodyear Lifeguard is a tire within a tire. On the reserve air chamber thus provided an automobile may be driven to a safe stop even after the most severe blowout.

An important development of the Norton Company is a water-clear resin, about half as heavy as glass and so tough that it is nearly unbreakable. This new material is destined to occupy a prominent position wherever optical glass is required.

Industrial research of the Owens-Corning Fiberglass Corporation has produced glass in the form of strong pliable fibers that can be felted, woven, and even tied in knots. It is used as a lightweight insulator, and its dielectric properties plus its high heat-resisting give new efficiency standards to electric equipment.

Soil-cement roads for light traffic have been sired by the Portland Cement Association. An old roadway is pulverized to a depth of six inches and a carefully predetermined amount of Portland cement is spread over the soil to be mixed by field cultivators, gang plows, or harrows. After adding the proper amount of water, the mixture is compacted from the bottom with sheep's foot rollers to required density, struck off to crown and grade, and ironed out with heavy smooth rollers. Other uses of soil cement are airport runways, park drives, residential streets, tennis courts, ditch linings, earth dams and adobe-type building blocks.

The words of Alfred Sloan probably accent the true significance of these engineering trends. "Industrial horizons have been lifting in spite of the difficult problems of the last five years — new concepts in science and research, new techniques in production and distribution, and, above all, the beginning of a new understanding of the true function of industry as an integral part of our social and economic life."



Steam Lab *P. Westervelt, '42*

Technology

ALSIFILM

A new film called "Alsifilm" to go on the market soon is the discovery of Dr. Ernst A. Hauser, who is in charge of colloidal chemistry research in the Chemical Engineering Department at the Massachusetts Institute of Technology. It is an aluminum or magnesium silicate film which may be made into transparent sheets. It is made from bentonite clays containing montmorillonite which swells considerably in water to form a gel when in concentrated solution. Complete desiccation of the gel when spread out on a surface leaves a film with a fabric-like structure. The transparent film is made from the gels containing the finest colloidal particles obtained by centrifuging the initial solutions.

By treating the film under high temperature or pressure or both, the water resistant and electrical properties are improved. These same properties may also be altered by chemical treatment of the film. By Dr. Hauser's method "Alsifilm" becomes absolutely water-resistant, is unaffected by boiling water over a long period of time, non-reactive to acids, electrolytes, oils, or grease. It is absolutely non-attackable by organic solvents and will withstand very high temperatures.

Mineralogically similar to mica, "Alsifilm" has very good dielectric properties. Produced as thick, rigid sheets which are brittle, it is used, for example, in condensers. Its advantages over mica are the availability of unlimited size and uniformity of thickness and texture. Such sheets of the material when made flexible can be used for wrapping cables.

The film can be treated with many kinds of dyes and pigments. Its gloss can be increased, and it may be made absolutely opaque or dyed and made transparent in many colors.

Although its tear resistance is low, this characteristic can be improved by special treatment depending on the film's intended use. Its most important application is in electrical insulation. It may be used for recording and preserving valuable records. It is also expected to be used widely in the transparent packaging field.

THE HOUSE IN WELLESLEY, WHY?

As part of its undergraduate course, the School of Architecture at Technology designed and supervised the construction of a house built in the town of Wellesley in 1936. When completed, the house was sold and is now the home of a well satisfied family.

This educational project captured considerable attention as a novel method of teaching and has been generally commended. The less obvious purposes back of it and its continuation and development in the course called Architectural Practice are not so well known and may be set forth here.

Perhaps the major purpose is to make available to each student an experience which will help him comprehend just what constitutes the practice of his intended profession. As a result, he is likely to pursue his consequent studies with a more intelligent attitude. He is likely also to retain fewer illusions about architecture as a career, and be inclined to a more resolute application to his training. On the other hand, he may more quickly redirect his interest if he discovers that its demands are unattractive.

Another more evident purpose is to equip students with sufficient knowledge and skill, as draughtsmen, to be of use in an architect's office. This increases their opportunity to devote the summer months to the practical experience, so much of which must somehow be acquired to supplement their academic training.

That the whole is greater than any of its parts is too obvious to require exposition, yet it is an axiom readily forgotten. Its truth applies with particular aptness to the education of the architect and to his practice. His field decidedly is not that of pure research nor of analysis for its own sake. Always, he is the designer, creator, builder; his powers are preoccupied with synthesis, that is, with masterfully combining, applying, adapting, relating and organizing of an infinitude of things, large and small.

Because modern building is becoming increasingly complex, it is essential that some qualified person be in a position of control in the production of buildings. Thus a fitting balance, the relation of the parts to the whole, and a certain aesthetic quality can be effected so that the final structure will suit the original purpose. This person is the architect.

Wellesley Home of 1936

Buildings are not devised by the all-knowing mind of one man, but by the close co-operation of many men, technically proficient in their separate fields. To integrate and coordinate their work has become a large part of the architect's responsibility. To do this effectively, his education involves among other matters, an understanding of a number of branches of engineering,

though by no means a complete working facility in their technical detail. As a symphony production is impossible without the director, surpassed though he may well be by each player in his own part, so a successful building implies the architect.

The evolution of an architect from the time he comes to us, eager and uninitiated, is a long and devious process. With his graduation midway, a period of ten years of study and work as an average is to be anticipated. While with us, he is exposed to systems of ideas and to personalities strange to him. He is immersed in an environment, an atmosphere, a stimulating climate, a culture medium. Doors are opened to enticing vistas of knowledge, activity and experience in many directions. For him to find his way is difficult, to lose his way is easy. He properly expects that after five years with us he will be well advanced toward his goal. We are convinced that he will proceed more surely, during those years and thereafter, if he sees the path and the objective as they are.

Formal education is of necessity broken into fragments: one course of study and another, one professor with his special interest and another, an hour here and an hour there, shifting attention from one to another system of ideas at the stroke of a bell. Were no provision made as part of his training, it is conceivable that a student could study subject after subject and obtain a creditable rating in each, and be graduated with yet no comprehensive understanding of what the work of the architect really is in this modern world.

And so the course in Architectural Practice is set up to make possible for each student, at the beginning of his education, the full range of experience, so far as possible, in which an architect is involved in the planning and construction of a house. Obviously, a small house is the most suitable problem for this purpose. While small, it is sufficiently complex to be a typical case; there is a ready market for it when completed, and each student has a certain familiarity with the problem, previously acquired.

Recognizing that students come to us with varied preparation and background, and with usually no training directed toward an architectural career, we spend the first term in getting ready for the house project itself.

Lectures of a general nature, illustrated by many incidents from experience, sweep over the field of the architect's practice explaining scope and method. Carefully devised draughting exercises quickly develop a fair facility in architectural indication. Lectures and discussion of desirable and undesirable matters affecting the value of house lots precede a search for and choice of a lot by the students in the suburbs of Boston. If approved it is purchased by the Institute.

Lectures of an elementary nature in simple survey work precede a day spent by the class in the field, determining the contours and other physical characteristics of the chosen lot. Typical wood construction is studied by full size models, by lectures at the blackboard, and by drawing in isometric. Glass discussion, library research, and many brief sketch exercises help to analyze the functions and acceptable ways of arranging spaces in a small house.

The second term of the first year is spent in designing the house and in making all the details needed in its erection.

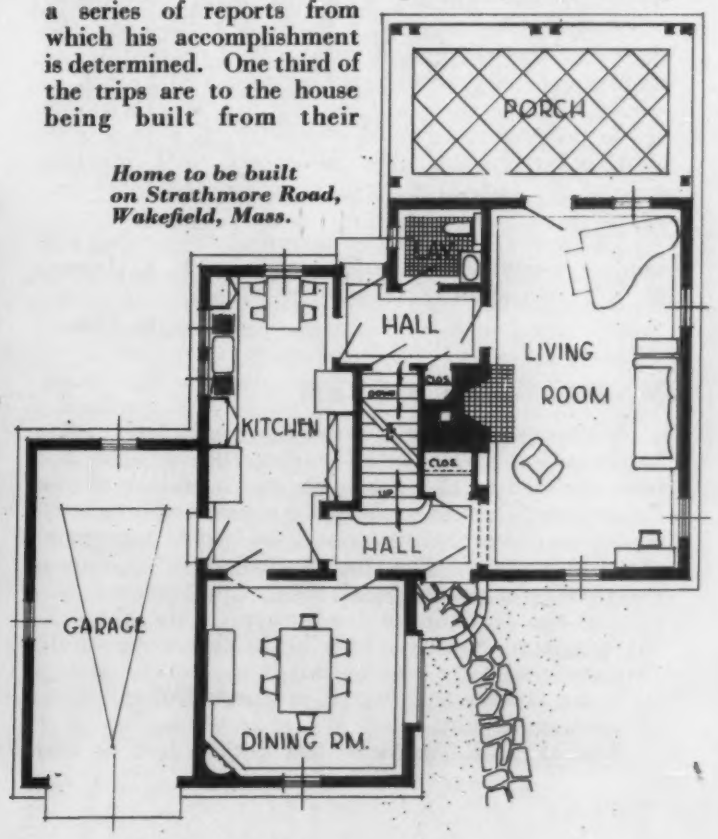
An afternoon of directed class discussion establishes the program of requirements for the house. Each student thereupon develops a design and indicates it as clearly and attractively as he can in a set of sketches for judgment. From these, a choice of two or more is made. Thereafter, the class, working in squads, prepares the complete working drawings and all scale and full size details of the several houses. When completed, these are judged, and a final choice of the house to be built is made.

This method of handling the class gives the experience, as in an office, of working co-operatively in groups, and also keeps the interest at a high level because of the element of competition, first between individuals and then between squads. It also happens that the discipline for both students and staff, confronted with the prospect that the house may be built, brings into the classroom a serious attitude toward the work which is of the utmost value.

During the second year, the house is built under contract after the usual competitive bidding by a selected list of contractors. Meanwhile the class spends one afternoon each week in field trips, each student writing a series of reports from which his accomplishment is determined. One third of the trips are to the house being built from their

designed by architecture students — *E. M. Bridge*

Home to be built on Strathmore Road, Wakefield, Mass.



FIRST FLOOR PLAN

drawings, a third to other construction jobs to observe the same principles being applied to larger and varied buildings, and another third of the trips, during the winter weeks, to shops and mills of many kinds where materials are being prepared for architectural construction.

At the end of the two years' work, a series of several lectures with discussion are employed to review and summarize the entire course and to unify and clarify the students' comprehension of architectural practice.

The value of this experiment in education, now in its fourth year of trial, is being demonstrated as the students move up through the school, and though the unfortunate impact of changing conditions in general business and in real estate has prevented a settled policy, the methods developed and developing promise to be a real contribution to our part in the training of architects.

EDWARD M. BRIDGE,
Assistant Professor in Architectural Practice.

CHEMICAL ENGINEERING SUMMER SCHOOL

The Chemical Engineering Department announces a special Summer School course in Colloid Chemistry and Physics, to be given under the supervision of Dr. Ernst A. Hauser. Colloid chemistry and physics are becoming increasingly important in such industries and sciences as medicine, biology, and geology. Our knowledge of the colloidal state of matter in general and of some of its typical reactions has been considerably extended and has become more profound, thereby opening up increasingly larger fields for application of this new branch of science.

The course in Colloid Chemistry, 10.641, will begin on July 24 and will continue for five weeks. Lectures and round-table discussions will occupy about ten hours a week, laboratory work thirty hours, and preparation twelve hours. The lectures will include a general but detailed survey of the fundamentals of colloid chemistry and physics with the main purpose of familiarizing the group with the basic colloid physicochemistry and the reasons why colloid chemistry and physics are today considered as a special branch of science. The lectures will also outline the application of the principles of colloid chemistry to a variety of industrial problems. The laboratory work includes most of the techniques used in colloid chemistry and physics.

All applications and correspondence regarding this summer course should be addressed to Dr. E. A. Hauser, M. I. T., Room 2-013, Cambridge, Mass.

JERRY COE.

MATHEMATICS CLUB

Mathematics holds a very important place at the Institute, but heretofore all mathematical activity has been confined to the classroom and members of the Department. At the request of a number of interested students a new organization has been formed to promote the popularity of "The Queen of Sciences." The new organization is patterned after other professional societies at the Institute and is known as the M. I. T. Mathematical Society. This is the first opportunity that students have had to meet on common ground with the faculty and discuss mathematical questions of common interest.

The M. I. T. Mathematical Society had its first meeting March 11, 1939. This first meeting was merely for the purpose of organizing the club, electing officers, and accepting the constitution. The next meeting sent the club off to a flying start with Professor Wiener giving an elementary discourse on "The Theory of Numbers." The attendance at this meeting was about seventy in all, the active membership of the club being twenty-one. The club intends to pursue this subject further with several more talks, each a little more advanced than the preceding one. Professor Martin addressed the club on "The Calculus of Variations." The attendance was also quite large at this meeting. The intent of the club is to present talks which are of special interest to the students and quite apart from regular studies.

Talks are also being encouraged from the membership at large. The program of the next few meetings will consist of addresses given by students and professors and discussions on various problems and topics of group interest. There are also varied social functions being planned.

Far-reaching plans of the club are only tentative but have interesting possibilities. Numbered among these would be the sponsoring of an interscholastic mathematics contest, membership in a national society, and publication of a club paper.

MARVIN EPSTEIN,
President Mathematical Society.

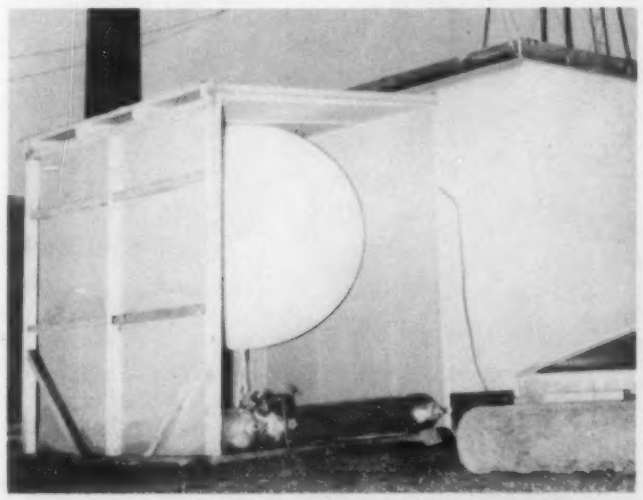
METEOROLOGY

Research of practical significance is being conducted in a branch of meteorology. That branch is "Air Mass Analysis." The work, done in anticipation of transatlantic air service, involves collecting data from upper air regions and synthesizing the data by means of formulae into short termed weather forecasts.

Since the first of April four stations have co-operated in obtaining data by making simultaneous observations along the North American coast line. The government weather bureau works in conjunction with these stations which function in addition to ordinary weather stations. It is expected that observations will be carried on for a period of three months.

Harvard University and Blue Hill Observatory maintain a station at the Massachusetts Institute of Technology which makes daily radio soundings. All three groups have pooled their resources for this work.

One of these hydrogen cylinders will fill three balloons



T. E. N. Photograph

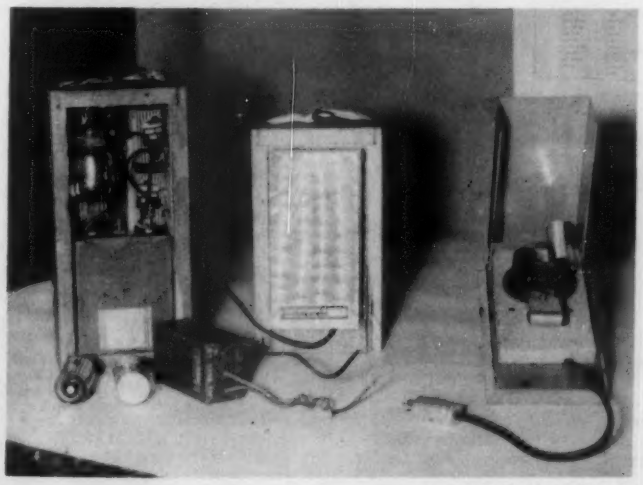
M. I. T.'s meteorological department also operates a station in Bermuda, for which most of the equipment in use was donated by the Julien P. Friez Co., makers of a new type of radio-meteorograph. Two other stations belonging to the United States Coast Guard each function in a cutter. The two cutters, *Champlain* and *Chelan*, alternate between an ice patrol southeast of Cape Race — in the Grand Banks — and Halifax, Nova Scotia. Three weeks at each post, the ships refuel at Halifax.

There are several stations in the Northeast Atlantic operated by European weather services. They also specialize in Air Mass Analysis. The French government is making observations, including soundings at Angra in the Azores; also from the French steamship *Cari Mare* afloat halfway between the Azores and the coast of Portugal. These two temporary stations operate in addition to two permanent stations at Paris and Bordeaux. The Norwegian government works three temporary stations: one on the northwest coast of Norway, one in Iceland, and one in the Faero Islands.

"These simultaneous observations over most of the North Atlantic will cover a large part of the probable route of future transatlantic air service. It is expected that these observations will be of considerable value in studying the flying weather over this airway." So comments Mr. Delbar P. Keily of the M. I. T. meteorological laboratory. No longer is it sufficient to know surface conditions, but data must be had at altitudes to which airplanes fly. Mr. Keily is occupied with the problem of bringing to earth information concerning atmospheric conditions miles above.

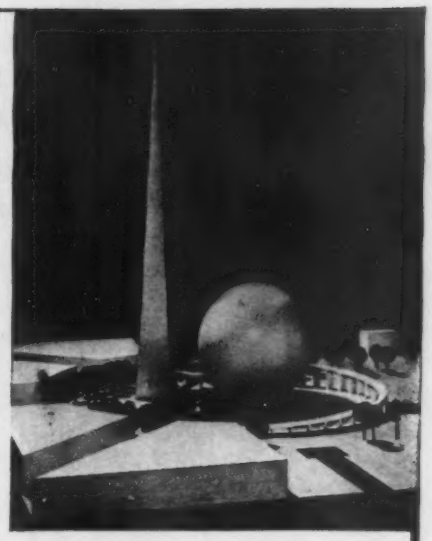
Daily from the roof of the Guggenheim Aeronautical Laboratory Mr. Keily and Mr. Edward M. Brooks send a balloon into the stratosphere. To the balloon is attached an ultra high frequency transmitter which is powered by two flashlight cells and a ninety volt "B" battery. Midget batteries as employed are shown in the foreground of figure 1. Using a type '30 tube the transmitter generates a signal on about five meters which is heard for more than fifty miles. Attached to the transmitter is an ingeniously simple instrument embodying: 1, a clockwork mechanism; 2, a barometer; 3, a thermometer; and 4, a hygrometer. Every thirty seconds a complete weather report is sent out in the form of dashes. Signals from the balloon pass through a conventional receiver whereupon they are amplified to sufficient intensity to actuate a relay. A second relay, mechanically connected to a recording device, which

Figure 1. Transmitter at left — Radio meteorograph in middle —Meteorograph at right



T. E. N. photograph

THE SHAPE OF THINGS TO COME



The shape of things to come is planned today on the drawings of architects and engineers. Drawings that contribute to the advancement of architecture and engineering must be able to withstand the ravages of time. That is why such plans are drawn with Higgins Waterproof Black Drawing Ink.

So, in preparation for your own future, Higgins — smooth, jet-black and even-flowing — helps you to do better work. For more than 50 years Higgins has been the standard India Ink among engineers, architects and students who plan ahead.

Your College Store has Higgins American Drawing Inks in waterproof and soluble blacks, 17 brilliant waterproof colors, white and neutral tint.

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can be seen on the right of figure 1, impresses a series of black dashes across a constantly moving sheet of paper. From the relative position of the dashes the temperature, humidity, and altitude of the air surrounding the balloon may be calculated.

In times past kites, captive balloons, rockets, and airplanes have been employed to carry meteorological instruments to heights of from one to thirty kilometers. Since the first radio-meteorological soundings, made by a French captain in 1929, balloons have yielded the most favorable results. The instruments and the balloon for one flight cost between twenty and thirty dollars. Airplanes, while still used at some stations, will eventually be replaced by balloons. This is due to the risks in making ascensions in questionable weather and the relatively high cost of flying. The balloons are made from a rubber compound known as latex. Filled with hydrogen to a diameter of four feet on the ground, they expand to the bursting point, twelve to fifteen feet in diameter, at a height of twenty to twenty-five kilometers. Parachutes attached to the instruments prevent possible casualties resulting from high speed impact of the radio with objects below.

Since the war, formulae have been worked out for dealing with the complex turbulences of our atmosphere, formulae which treat bodies of air according to laws of fluid dynamics. A quasi-science known as Air Mass Analysis has developed from this new attack on weather forecasting. Progress in this field has amounted to making more exact observations and classification of data. The difficulty of a quantitative treatment here is due to too meager a concept of the forces acting.

P. WESTERVELDT, '42.

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SUCCEEDING ON A JOB

(*Continued from page 76*)

how to get along with people . The excellent engineering technique of reducing material and physical factors to definite formulae has contributed greatly to our material progress, but the engineer should understand that in human relations the formulae technique has little application. Therefore, you must supplement your technical training so that you will know something about people as well as things.

Another important element in succeeding on a job is the ability to express your ideas, both in writing and in speech, clearly and forcefully. Here again, the usual engineering curriculum does not provide sufficient opportunities for training. There is truth in the waggish remark that an engineer must be equipped with slide rule or log book before he can express himself. The acquirement of an adequate vocabulary (one of the best ways to do this is to read good books) and the development of your ability to express yourself with confidence, clarity, and force should receive your earnest attention. After all, it is of little use to have ideas if you are incapable of making them known to others.

There are, of course, many other things which can and should be done prior to your getting a job, but those already mentioned — an honest appreciation of the significance of work; actual experience in earning, spending, and saving your own money; a desire to stand on your own feet; an appreciation of the advantages and limitations of a college training; recognition that the only thing the world owes you is a chance to use whatever brains and abilities you may have; the ability to express your ideas clearly and forcefully — will be of more help than perhaps you now realize in succeeding in whatever work you may later undertake.

Now let us assume that you have prepared yourself as well as you can before actually getting a job. What then are some of the things to do when you have been fortunate enough to get your name on a payroll? Well, if you talk with those whose opinions are based on practical experience, there are many who will encourage you to forget that you are a college graduate, or that your father, uncle, or grandfather is a person of position or prominence. Most employers are interested only in what you yourself can do. You may get a job through "pull" or family influence, but unless you have the ability to produce results, it is unlikely that your services will be retained.

The fact that you have been exposed to academic and other training should mean that you have acquired certain tools — but it is another thing to use them effectively. You will find that actual experience and

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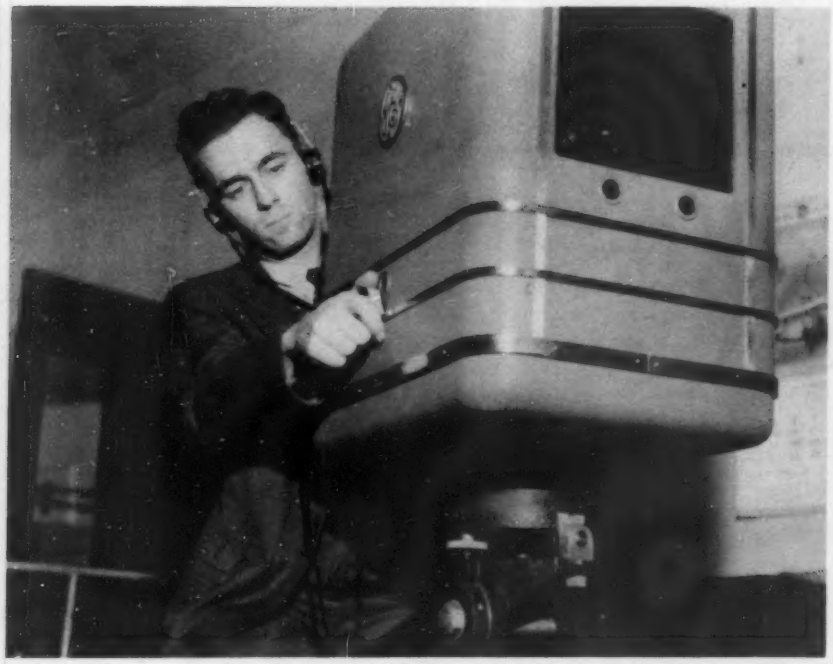
practice during the time that you are acquiring these tools will be of tremendous help in their later use. The co-operative system of education provides an excellent method of bringing about this correlation.

In the process of selecting a job you will have given serious thought to what you want to do and why you want to do it. Having found a job with an organization which you feel offers the type of work you want to do, you should not be critical about your first assignments. It is unlikely that you will start with even a minor executive job. Remember that a good way to get ahead is to develop and explore each job to its fullest extent; do more than you are told, and take advantage of every opportunity to prepare yourself for the next job.

Notwithstanding the fact that you have graduated from college there is still much for you to learn. You will find many men whose formal schooling has been very limited, but whose knowledge of many subjects is far superior to yours. Welcome an opportunity to work with all kinds of men — learn to understand their thoughts and the reasons behind them. All of this will be helpful to you if, in the future, you should become responsible for the work of and the relationships with such men. In a word, continue to develop your ability to understand and get along with people.

In dealing with your fellow workers and your superiors, learn to be tactful and diplomatic. You may have already found that asking questions is one of the most tactful and diplomatic ways of getting, and also giving, information. It pays to consider the feelings and viewpoints of others, and even though the opinions of others may be wrong, there is little to be gained by attempting to prove they are wrong. It is better to back up your own opinions with such sound reasons that your listener will want to change his opinions and accept yours. A sense of tact is also a fine asset — there are already too many who are attempting to emulate Atlas. Have confidence in yourself and the courage of your convictions. Above all, be loyal to your employer.

Although succeeding on a job is very important, and you want to do everything you can to make this possible, you should not lose sight of the fact that you must live as well as work — that you have a definite obligation to make your contribution to the advancement of society. In the words of an outstanding engineer, "Living a well-rounded life should be our main job."



TRANSPARENT CELLULOSE FILMS

(*Continued from page 78*)

Of constantly growing interest to the electrical industries are the dielectric properties of these cellulose-derivative films, all of them being superior to paper. The regenerated cellulose film is not the least interesting of these materials for dielectric purposes. Not highly porous and having both a higher dielectric constant, and a higher strength than paper, its great resistance to electrical stresses makes it superior to either gauze or paper in condensers.

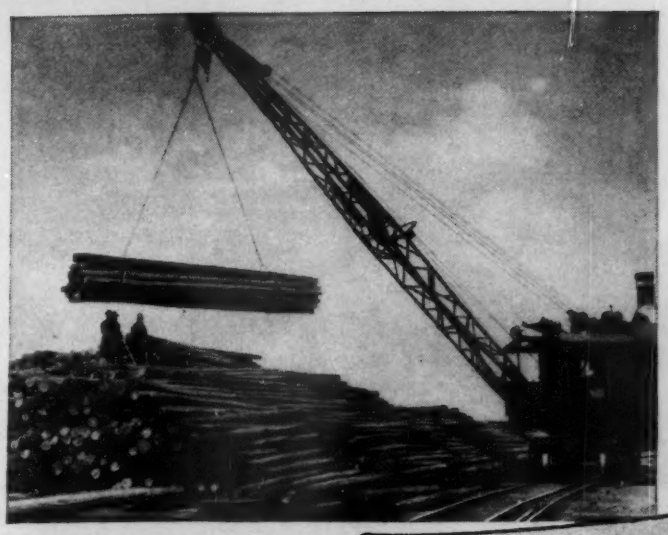
As an insulating material for wire, it has many advantages. Exceedingly thin sheets of the film are slit into small ribbons from 1/32 to ¼ inch in width, and stored in spools. Machines spin the strips around the wire thousands of times per minute with mathematical accuracy. Even with special adhesives for a permanent bond and top dressing of lacquer, a coil of wire thus insulated takes up about four-fifths of the space that a coil of double cotton-covered wire would take. This space-saving insulation used in the rotors and fields of motors means smaller motors with greater horsepower. In one case the use of this type of insulation reduced the incidence of trouble caused by corrosive fumes permeating the windings. Used in the magnetic field of a gantry crane, a coil with a greater number of turns in it can be used, and the heat generated in the windings is dissipated faster through the cellulose insulation than through other materials.

From these properties, and their related uses, one can see that regenerated cellulose makes a very versatile film. It has, however, many more uses, less scientific in nature, ranging from the one extreme of surgical "windows"— surgical dressings needing constant surveillance — to that of colossal movie sets, as in "A Midsummer Night's Dream," in which the shaft of light on which the fairies danced down to Earth was a stupendous set using this film. It protects foods of all kinds, tobacco, drugs, and textile products, such as shirts and hose. It makes striking artificial flowers, millinery trimmings, and stock market ticker-tape. Narrow ribbons of the film can be woven into cloth to make lustrous dress fabrics and draperies. When laminated to a fabric — a process closely akin to Dr. Brandenberger's first attempts to produce the film — it lends sheen to the cloth and makes a fine-mesh fabric exceptionally usable for such protective articles as shoe bags and dress covers. As a support and medium for impregnating the sensitive silver salts used in photography, the film is being used in the motion picture industry. Since the film is printable it is also used in rolls for lantern slides.

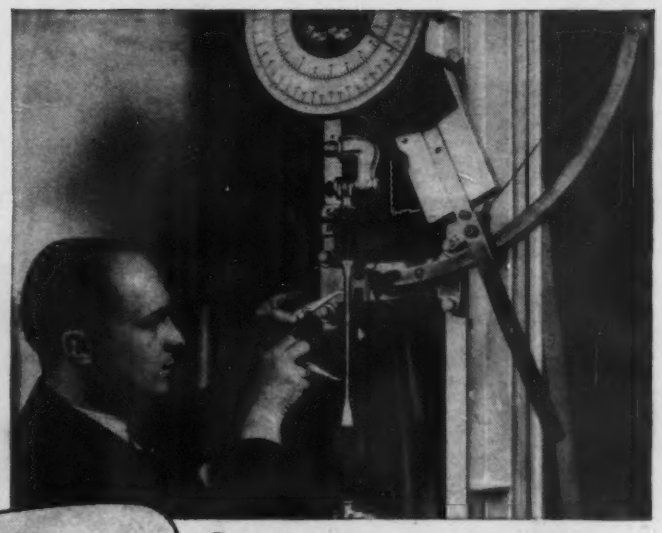
The uses and properties of the various films just discussed has perhaps aroused interest in the processes of their manufacture. The present day methods are fundamentally similar to those employed when the films were first put on the market. The raw materials generally used are sheets of purified wood pulp and cotton linters. In the manufacture of cellulose acetate plastics, cotton linters alone are used.

The production of cellulose acetate plastics starts by first steeping the cotton linters in a caustic soda solu-

(*Please turn to page 88*)



(1) Poles are only one of the hundreds of items which Western Electric supplies.

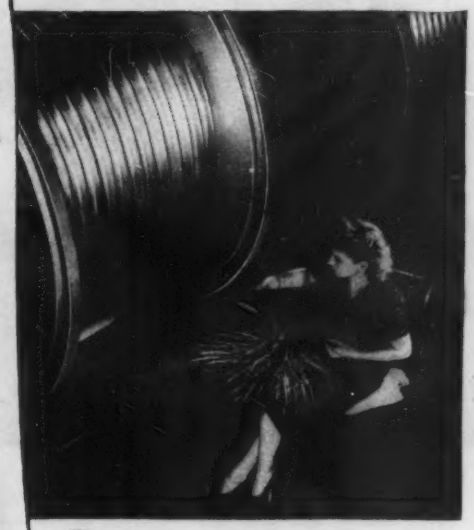


(2) All materials must pass severe tests. Here an engineer tests a sample of that important little item — rubber tape.

Some things Western Electric does . . . so you can say . . .

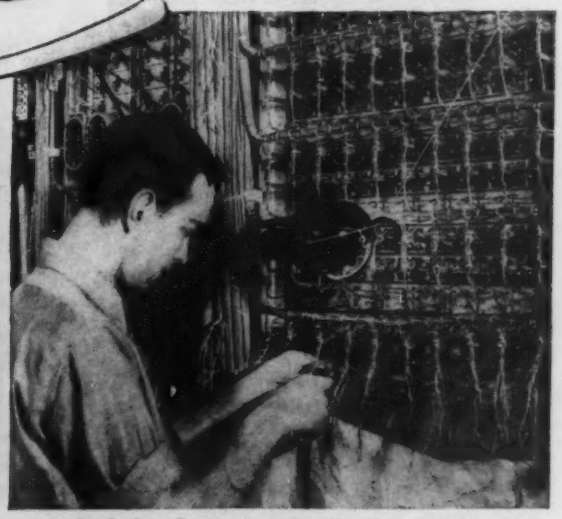
"It's good to hear your voice"

(3) Moulding handles for telephone handsets—one of 248 parts in your Bell telephone.



(4) Each of the three thousand, six hundred thirty-six wires in this cable is given a thorough electrical test.

(5) Twenty-nine distributing houses furnish the Bell Telephone companies with practically everything they require.



(6) And the Company installs the equipment in telephone exchanges.

Western Electric

. . . made your BELL TELEPHONE

Silhouette — *William Schubert,' 41*

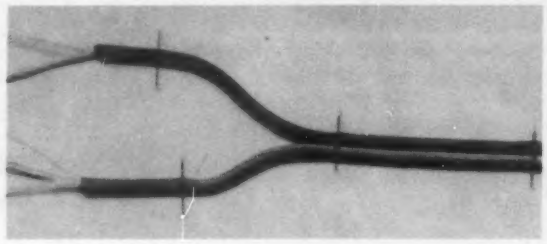
TRANSPARENT CELLULOSE FILMS

(*Continued from page 86*)

tion after which they are bleached, washed, dried, and fluffed up to be compressed into bales. The purified cotton linters are acetylated with both acetic acid and one of its anhydrides in the presence of a catalyst. The product of this reaction is cellulose acetate. After the excess acid has been removed, the new substance is formulated into a flexible plastic by the addition of certain plasticizers or softeners.

Solvents next reduce the mass to a doughlike consistency, after which kneading on large chromium colloiding rolls removes excess solvent and provides compactness and uniformity. Built up into one inch thick slabs, a number of which are loaded at a time onto a steel plate, the mass is molded into a solid cake in huge baking presses under high pressure. The steel plate is next bolted onto a traveling platform which passes back and forth under a very sharp blade, shaving off sheets of whatever thickness wanted. Seasoned in special cells, under constant temperature and pressure, the sheets are next pressed at high temperature between highly polished nickel-steel plates, producing a smooth, highly lustrous surface. The material may be finished by coloring, mottling, or impressing patterns or configurations. This rigid material in transparent form is the type used for Monsanto Vue-Pak containers.

Cellophane protects this wire from the corrosive effects of sulphur in vulcanized rubber covering



Cellulose acetate film, which is made by the Eastman Kodak Company, is made by treating cellulose acetate with a suitable solvent and then with a plasticizer. The substance is next cast on a wheel surface, the solvent evaporating to leave the thin sheet which is stripped from the wheel and wound on cores ready for use.

As has already been inferred, the commercial production of the regenerated cellulose film has been carried on in this country by duPont if not for a longer time certainly on a larger scale than that of the other cellulose films, and is, therefore, more widely known. The film is produced from viscose, the same substance used in the manufacture of rayon. The only difference between rayon and the film is physical: rayon is a thread while the film is a continuous sheet of regenerated cellulose.

The process for making the regenerated cellulose film, which is here described in detail, begins with the steeping of rectangular

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sheets of bleached pulp in presses containing an approximately 18 per cent solution of caustic soda at a constant temperature. The fibers swell, forming an unstable alkali-cellulose, while the less complex cellulose compounds, called hemi-celluloses, dissolve in the caustic. The caustic solution is pressed out until the weight of the alkali-cellulose is about three times that of the dry pulp. This substance is shredded mechanically into a finely divided state.

The alkali-cellulose is aged in containers at constant temperature for a stipulated number of hours in order to obtain the proper viscosity of the viscose. The white product is removed to double-walled, tightly closed, rotating, barrel-shaped containers in which it is reacted with carbon disulphide to form an orange-red ester, cellulose xanthate. This substance, mixed with dilute caustic, forms a uniform colloidal solution called viscose. The viscosity of this viscose varies inversely as the aging time of the alkali cellulose. To be coagulated and regenerated successfully, the viscose must be ripened at constant temperature, a process including a series of complex reactions not yet fully understood. The desired state of coagulability for casting the viscose is reached by determining the "salt number" or concentration of sodium chloride solution necessary to start coagulation of small amounts of viscose solution. All gaseous impurities are removed by vacuum prior to casting.

In all machines built for casting continuous films, the viscose is forced through an accurately adjusted slot in a casting hopper into a sulphuric acid-sodium sulphate coagulating bath where the cellulose xanthate is regenerated into a soft, flexible cellulose film. Here is where the process differs from the manufacture of rayon. For rayon, the viscose is forced through pin holes into the coagulating bath, thus forming a thread instead of a film.

From the coagulating bath the sheet passes over a series of rolls through succeeding tanks of fresh warm water which removes the residual acid, into a desulphuring solution of sodium hydroxide, sodium sulphide, or sodium sulphite, then another washing followed by a bleaching tank of sodium hypochlorite, to a solution of glycerol which gives it soft and pliable characteristics. Now completely formed, the film is dried over heated rolls and wound on cores ready to be inspected for low transparency and imperfections before being finished or put direct into use.

Cellophane that has been made moistureproof has excellent characteristics. In tests to determine the amount of water vapor that will permeate the film under given conditions, a piece of the film was sealed over a dish of water. The dish was placed in an air oven at 100° F. for about 30 hours. The air was kept in circulation, and desiccated by concentrated sulphuric acid in trays. The loss in weight was determined and compared with similarly tested, average, waxed, brown paper. The permeability of the waxed paper was found to be about 74 times as great as that of the moistureproof Cellophane.

Moistureproof film is used mainly for packaging foodstuffs. It was necessary, though, to develop new

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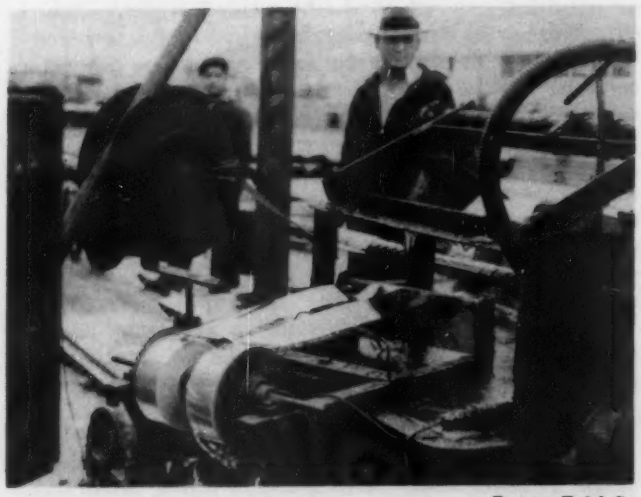
adhesives and heat sealing properties for sealing purposes before the product was generally accepted by the food producers. Many tests have been made proving the value of wrapping staple products as well as perishables with the material. Soda crackers in an envelope were exposed at room temperatures and 70 per cent relative humidity, and showed a gain in weight of 3.1 grams in 48 hours. Wrapped in moistureproof film, the biscuits gained only two grams after 6½ months' exposure. Moistureproof cellulose film revolutionized the merchandising of cigars and cigarettes. Tests showed that unwrapped cigars lost 85 per cent of their moisture, 58 per cent when enveloped in nontransparent paper, but only 30 per cent when enclosed in the moistureproof regenerated cellulose film.

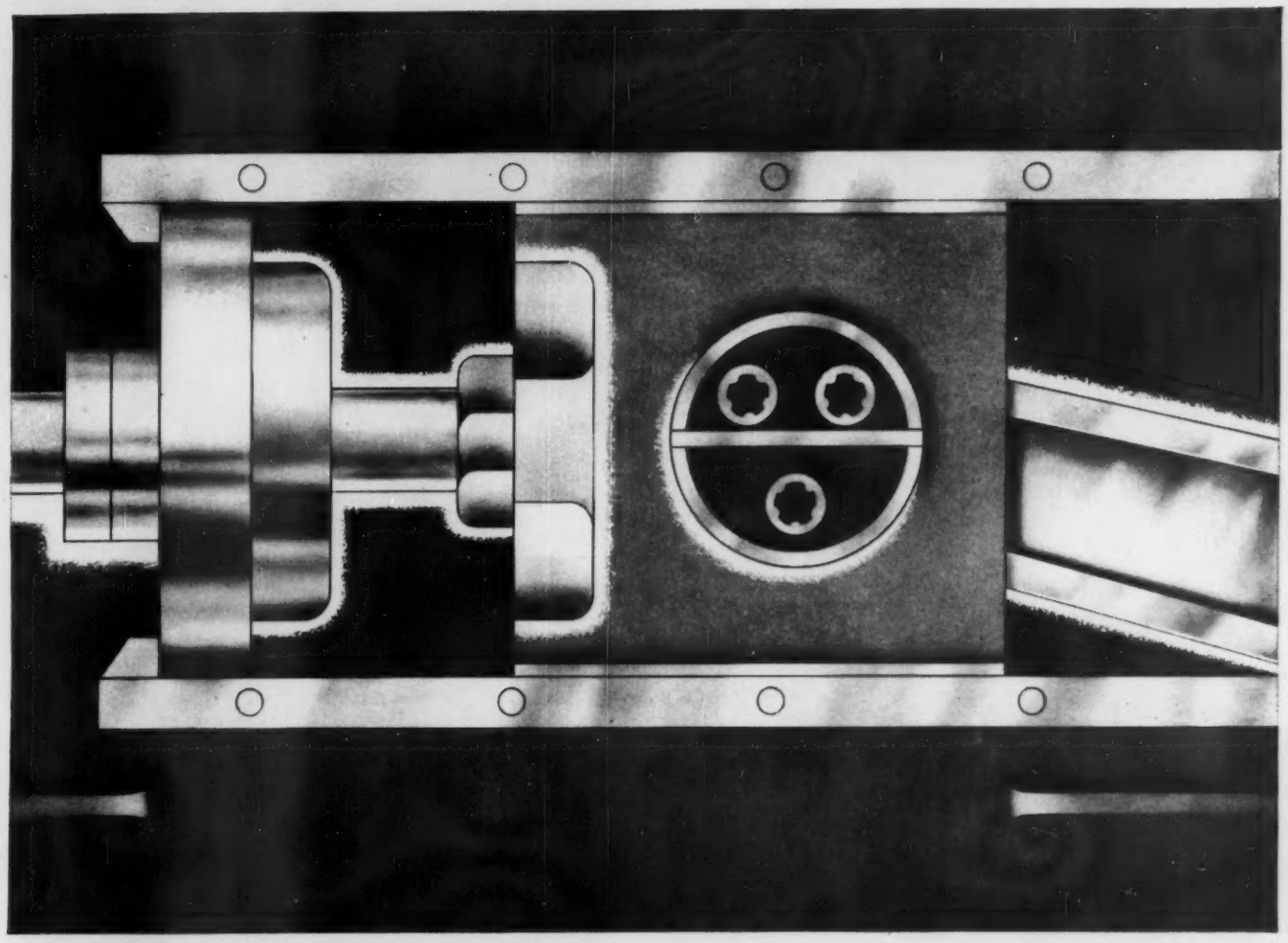
The future of transparent films glistens with possibilities for these films have an interested sympathetic public. Consumer demand has forced many manufacturers to wrap their products in a transparent material.

The packaging trade still offers many fields to be developed. The frozen food and cracker industries were large scale developments last year as was another new field, the ready-to-cook poultry industry. There is also a future in other fields including the textile, electrical and motion picture industries. Begun only a little over thirty years ago (in this country, fifteen years ago) as a scientific novelty, the manufacture of transparent films has sprung into an established industry able to stand on its own feet and demand acknowledgment by other businesses. Furthermore, it has provided work for thousands of people where work never existed before. More adaptations of the films of course mean a greater demand on the output and hence a continued growth of the industry for many years to come.

Coating underground pipes with asphalt and Kodapak to retard corrosion



Eastman Kodak Co.



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G-E Campus News

IT CUTS SOME ICE

NICODEMUS, the brown-nosed seal, playfully swam up to the North Pole, tripped the circuit-breaker and plunged Santa's workshop into darkness.

Absurd? Not as far as the successful operation of G-E outdoor air-break switches is concerned. These have been placed in a special room in the General Electric Research Laboratory at minus 20 degrees Fahrenheit, sprayed with water, and tested when coated with ice to a thickness of one and a half inches. The powerful leverages shattered the ice as easily as a walrus swallows a fish. In each case the switches opened and closed properly.

This test is just one of the many which G-E equipment must pass. And the observers, who check the operations with pitiless eye, are members of the G-E Test Course—young college men in their first year with the Company.

OH! MUMMY . . . !

A SKELETON in the closet—a white-robed ghost in the attic—even Ichabod Crane's headless horseman—may well feel jealous of Harwa, the Egyptian mummy. For while conservative ancestors content themselves with rolling in their graves in a genteel way, Harwa is floodlighted in a golden glow in full view of the public in the G-E building at the New York World's Fair.

This unusual exhibit is designed, not to frighten women and little children out of their wits but to demonstrate one of the many uses of x-rays. By pressing a button, an x-ray machine is turned on, and an image of Harwa's skeleton appears on a fluorescent screen which moves in front of the mummy. The principle employed is the same as that by which a doctor may fluoroscope a broken bone, except that the entire body of an adult person is viewed.

Harwa lived 2800 years ago, in Egypt. From inscriptions on the coffin lid it is learned that he was overseer of storage houses on the great farming estate of one of the temples of Amen, chief god of the empire. Pathological study of the mummy by means of x-ray indicates that Harwa was probably forty years old at the time of his death. And now, nearly 3000 years later, he is in his portable grave, a citizen of ancient Egypt in the World of Tomorrow.

FLOATING POWER

THE surging waves of a stormy sea are beautiful to an artist, disconcerting to a food-loving passenger, but just another problem to an engineer. Whenever a sleek, ocean liner plows her bow through a heaving swell, her engines feel an added load, and her captain wonders if the fuel will last. So, G-E engineers built an all-electric meter that will accurately measure the power put out by the propeller of any boat, from a tiny tug to a transatlantic greyhound.

The meter is essentially a combination of two electric generators mounted a little distance away from each other on the propeller shaft, and connected to instruments which can be located at any point on the ship. The generators are so mounted that at no load the voltages generated are exactly 180 degrees apart in phase and therefore add to zero.

When a load is placed on the revolving shaft, the torque causes a small angular twist in the shaft; consequently, the two generated voltages no longer add to zero. The resultant voltage is proportional to both the shaft twist and the propeller speed, and hence the meter can be made to read directly in horsepower. The installation can easily be modified to indicate total horsepower-hours and to write an automatic log of the power delivered during the trip.

Among the G-E engineers who developed the device are A. V. Mershon, Pratt Institute '13 and Union College '15, and C. I. Hall, U. of Illinois '10.

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